

**TITLE OF THE INVENTION**  
**CONDITIONING AND/OR CLEANING DEVICE**

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## **CONDITIONING AND/OR CLEANING DEVICE**

### **CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] The present application claims priority under 35 U.S.C. § 119 of German Patent Application No. 200 13 887.1, filed on August 11, 2001 and German Patent Application No. 100 44 907.7, filed on September 12, 2001, the disclosures of which are expressly incorporated by reference herein in their entireties.

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

[0002] The invention relates to a device for conditioning, cleaning and/or keeping clean a rotating roll and/or a circulating belt of a paper machine. Such a device is disclosed, for example, in DE-A-198 10 800.

#### **2. Discussion of Background Information**

[0003] The press sections of high-speed paper machines require a relatively high expense in terms of conditioning and cleaning rolls and/or circulating belts, including felts, in order to produce stable, good moisture cross profiles. Currently, attention in this field is primarily focused on conditioning felts and suction rolls. While it is possible to achieve satisfactory results with devices of the type mentioned at the outset under normal operating conditions, stable operation is not ensured under difficult operating conditions.

[0004] One problem that arises with the conventional paper machines is that a very strong lateral blowing of air and water occurs between the pressing stack of the first press, namely a roller press, and the subsequent suction felt guidance roll, which serves to separate the felt.

[0005] Conventionally, high-pressure (HP) spray bars are provided on the grooved and/or blind bored rolls and suction roll jackets (see, for example, DE-A-198 10 800). Among other disadvantages, these bars have the disadvantage of an

insufficient cleaning effect, a high water consumption, and causing a pronounced spraying mist.

#### SUMMARY OF THE INVENTION

[0006] The present invention provides a device of the type mentioned at the outset in which the above-mentioned disadvantages are removed and the cleanliness of the rotating roll is maintained.

[0007] According to the instant invention, at least two doctors arranged behind one another and at a distance from one another in the roll and/or belt travel direction are assigned to the rotating rolls and/or the circulating belt.

[0008] In this manner, an underpressure is hydrodynamically produced by a respective doctor. The corresponding hydrodynamic effects particularly occur due to the fact that the respective doctor is arranged in a diagonal position. While the front doctor in the roll or belt travel direction scrapes water off of the roll or belt surface, which is at least essentially open, i.e., in particular, grooved or blind bored, air is scraped off by the doctor arranged to the rear in the travel direction. Thus, the air intake into a subsequent wedge-shaped opening is minimized correspondingly. Such a wedge-shaped opening can, for example, result from the fact that the doctor is arranged in the roll or belt travel direction before a point where at least one felt approaches the roll and/or the belt.

[0009] If the doctors are arranged in the roll and/or belt travel direction before such a point at which at least one felt approaches the roll and/or the belt, it is advantageous if the doctor that is arranged in the rear when viewed in the roll and/or belt travel direction is connected at least essentially across the width of the machine to a boundary layer doctor arranged before the approach point of the felt and provided on the felt. Among other things, this prevents the air/water mixture carried along by the surface of the felt from arriving in the wedge-shaped opening and damaging the

cleanliness of the roll surface again.

[0010] A low-pressure suction can be provided for suctioning the space between a press preceding one of the rotating rolls and the rotating roll.

[0011] In a useful embodiment, a low-pressure suction can be provided for suctioning the wedge-shaped opening that is formed at least by the rotating roll, the felt approaching this roll, the rear doctor viewed in the roll and/or belt travel direction, and the boundary layer doctor provided on the felt.

[0012] It is useful for the distance between the boundary layer doctor and the felt approach point to be less than 500 mm, in particular less than 400 mm, and preferably less than 300 mm.

[0013] In a useful practical embodiment, the doctors are assigned to a suction felt guidance roll. This roll can, in particular, be provided subsequently to the first pressing section of the paper machine. This first press of the pressing section can be, for example, a roll press, or also a wide nip and shoe press.

[0014] A spray guard can be provided between the suction felt roll having the doctors and the first press.

[0015] In a preferred practical embodiment of the device according to the invention, at least one cleaning device impinging the surface of the roll and/or the belt is provided in the roll and/or belt travel direction between the doctors. Here, at least one jet cleaning or spraying device can be provided for the purpose of impinging the surface of the roll and/or belt with a pressurized medium. This pressurized medium can, for example, be a liquid, in particular, water, or air.

[0016] In certain cases, it can be advantageous for the cleaning device to include a combined blowing or spraying and suction device.

[0017] In a useful practical embodiment, the cleaning device includes at least one spray head rotating around its axis and traversing crosswise to the roll and/or belt

travel direction for the purpose of impinging the roll and/or belt surface with a pressurized medium. Thus, a highly effective cleaning is achieved with a minimal use of the pressurized medium.

[0018] The medium impinging the roll and belt surface is preferably under a pressure greater than approximately 20 bar and preferably less than about 25 to 30 bar.

[0019] The spray head preferably includes at least one nozzle tilted towards its axis. A vapor suction device, for example, can be assigned to the spray head.

[0020] It is useful for the cleaning device to be enclosed and/or surrounded by a housing that is open towards the roll and/or belt surface. Here, the enclosure or the housing can be sealed off from the roll and/or belt surface by way of the doctor.

[0021] In a preferable embodiment of the device according to the invention that especially facilitates conditioning, a unit is provided for evening out the amount of water supplied to a pressing nip in a grooved or blind bored roll surface or belt surface.

[0022] It is also advantageous to provide a unit for removing water from a grooved and/or blind bored roll or wall surface for the purpose of increasing the dry content of the fibrous material web, in particular paper or cardboard web, to be dewatered. This unit can also only have the purpose of conditioning, for example.

[0023] With the conditioning of a respective grooved and/or blind bored roll or belt surface specified above, the condition is taken into account, among others, that even small differences in the degree of fullness of the bores and/or grooves have an effect on the moisture cross profile of the fibrous material web.

[0024] The evening and/or water removal unit preferably include a device for blowing out the grooves and/or blind bores with a pressurized medium, in particular pressurized air.

[0025] The evening and/or water removal unit can include a suction device for suctioning water out of the surface of the roll or belt.

[0026] In a useful practical embodiment, a combined blowing and suction device is provided.

[0027] The evening and/or water removal unit preferably includes a device for applying a hydrodynamically produced underpressure on the surface of the roll or belt. Here, this device for producing underpressure can, in particular, include at least one diagonally arranged doctor, preferably at least one foil doctor.

[0028] The present invention is directed to a device for conditioning, cleaning, and/or keeping clean at least one of a rotating roll and a circulating belt of a paper machine. The device includes at least two doctors arranged behind one another in a roll and/or belt travel direction and spaced at a distance from one another. The at least two doctors are assigned to the at least one of the rotating roll and the circulating belt.

[0029] In accordance with a feature of the instant invention, the at least two doctors can be located before a take-on point at which at least one felt is guided onto the at least one of the roll and the belt. Further, a boundary layer doctor may be positioned adjacent the at least one felt before the take-on point. A rear doctor of the at least two doctors, when viewed in the travel direction, can be connected to the boundary layer doctor. Further, a low-pressure suction device may be arranged for suctioning a wedge-shaped opening formed at least by the at least one of the roll and the belt, the at least one felt, the rear doctor, and the boundary layer doctor. A distance between the boundary layer doctor and the take-on point can be less than approximately 500 mm, preferably, the distance is less than about 400 mm, and most preferably, the distance is less than approximately 300 mm.

[0030] According to another feature of the instant invention, a press may be

arranged before the at least one of the roll and the belt, and a low pressure suction device may be arranged for suctioning a space between the press and the at least one of the roll and the belt.

**[0031]** Further, the at least one of the roll and the belt can include a suction felt guidance roll. A first press of a pressing section of a paper machine can be provided, such that the suction felt guidance roll is provided subsequently to the first press. Further, the first press may include a roll press. Additionally, or alternatively, the first press may include an extended nip press. A spray guard can be positioned between the suction felt guidance roll and the first press. The spray guard may be arranged to extend substantially across a width of the machine.

**[0032]** Moreover, at least one cleaning device can act on a surface of the at least one of the roll and the belt. The at least one cleaning device may be positioned between the at least two doctors. Further, the at least one cleaning device can include at least one jet cleaning or spray device arranged to direct a pressurized medium at the surface. The pressurized medium can include a fluid or air, and the fluid may include water. The at least one cleaning device can include a combined blowing or spraying device and suction device. Further, the at least one cleaning device can include at least one rotatable spray head arranged to traverse crosswise to the travel direction and arranged to rotate around an axis. The at least one cleaning device can emit a medium onto the surface under a pressure that is greater than approximately 20 bar. Further, the medium can be under pressure less than about 30 bar, and further, the medium can be under pressure less than about 25 bar. The at least one cleaning device may include a spray head which is rotatable around an axis, and the spray head may include at least one nozzle which is inclined relative to the axis. Further, a vapor suctioning device can be provided, such that the spray head is assigned to the vapor suctioning device. Still further, a housing can be provided which is open to the at

least one of the roll and the belt. The at least one cleaning device can be enclosed and/or surrounded by the housing. The housing may be sealed off from the surface by the at least two doctors.

**[0033]** According to still another feature of the instant invention, the at least one of the roll and the belt can include a grooved and/or blind bored surface, and may be arranged to form a pressing nip. The device can further include a unit for evening out an amount of water supplied to the pressing nip. The evening out unit may include one of the at least two doctors, and the one doctor can be the first of the at least two doctors in the travel direction. The evening out unit may include a blowing device for blowing out grooves and/or blind bores in the surface with a pressurized medium. Further, the pressurized medium can be pressurized air. The evening out unit may include a suction device for suctioning water out of the surface. Still further, the evening out unit can include a combined blowing and suction device. The evening out unit may include a device for applying a hydrodynamically produced underpressure to the surface. The device for applying hydrodynamically produced underpressure can include at least one of the at least two doctors, and the at least one doctor can include a foil doctor arranged diagonally.

**[0034]** In accordance with yet another feature of the present invention, the at least one of the roll and the belt can include a grooved and/or blind bored surface, and the device can further include a unit for removing water from the grooved and/or blind bored surface, thereby increasing a dry content of a fibrous material web to be dewatered, which can include a paper or a cardboard web. The water removal unit may include a blowing device for blowing out grooves and/or blind bores of the surface with a pressurized medium, in which the pressurized medium can include pressurized air. The water removal unit may include a suction device for suctioning water out of the surface. Further, the water removal unit can include a combined

blowing and suction device. Still further, the water removal unit may include a device for applying a hydrodynamically produced underpressure to the surface. The device for applying hydrodynamically produced underpressure can include at least one of the at least two doctors. The at least one doctor can include a foil doctor arranged diagonally.

**[0035]** Other exemplary embodiments and advantages of the present invention may be ascertained by reviewing the present disclosure and the accompanying drawing.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0036]** The present invention is further described in the detailed description which follows, in reference to the noted plurality of drawings by way of non-limiting examples of exemplary embodiments of the present invention, in which like reference numerals represent similar parts throughout the several views of the drawings, and wherein:

**[0037]** Figure 1 schematically illustrates a device for conditioning, cleaning, and/or keeping clean assigned to a felt suction roll;

**[0038]** Figure 2 schematically illustrates a device for conditioning, cleaning, and/or keeping clean assigned to the lower roll of a shoe press; and

**[0039]** Figure 3 schematically illustrates a partial view of the traversing, rotating spray head of the device depicted in Figure 2.

#### DETAILED DESCRIPTION OF THE PRESENT INVENTION

**[0040]** The particulars shown herein are by way of example and for purposes of illustrative discussion of the embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the present invention. In this regard, no attempt is made to show structural details of the present

invention in more detail than is necessary for the fundamental understanding of the present invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the present invention may be embodied in practice.

[0041] Figures 1 to 3 show various embodiments of a device 10 for conditioning, cleaning, or keeping clean a rotating roll 12 and 14 of the pressing section of a paper machine.

[0042] Here, two doctors 16, 18 embodied as foil doctors and arranged behind one another in the roll travel direction L at a distance from one another are assigned to each rotating roll 12 and 14 in question.

[0043] In the embodiment according to Figure 1, the two doctors 16, 18 are assigned to a suctioned felt roll 12 that is provided subsequently to the first press 20 of the pressing section of the paper machine. In the present case, this first press 20 is a roll press. However, it can also be formed by an extended nip press.

[0044] As can be seen in Figure 1, the doctors 16, 18 are arranged in the roll travel direction L before a point 22 at which at least one felt 24 approaches the felt suction roll 12.

[0045] In particular, the doctor 16 can be a water stripping edge. It can be pressable against the roll. The doctor 18 can be an air stripping edge in particular.

[0046] The rear doctor 18 viewed in the roll travel direction L is connected to a boundary layer doctor 26 arranged before the felt approach point 22 and provided on the felt 24.

[0047] A seating part 30 can be seen between the suctioned felt guidance roll 12 having the doctors 16, 18 and the lower roll 28 of the first press 20.

[0048] It is advantageous for the distance a between the boundary layer doctor 26 and the felt approach point 22 to be less than approximately 500 mm, in particular

less than approximately 400 mm, and preferably less than approximately 300 mm.

[0049] Moreover, a low-pressure suction 78 is provided for suctioning off the space between the press 20 and the rotating roll 12. It can, for example, be provided for suctioning off this entire space.

[0050] However, a low-pressure suction 78 is also conceivable for suctioning off only the wedge-shaped opening that is formed by at least the rotating roll 12, the felt 24 approaching this roll, the rear doctor 18 viewed in the roll and/or belt travel direction L, and the boundary layer doctor 26 provided on the felt 24.

[0051] According to Figure 1, two water stripping edges 32 are assigned to the lower roll 28 of the press 20. In principle, such edges can be provided singularly or in a plurality.

[0052] In the embodiment shown in Figure 2, the device 10 of the lower opposing roll 14 is assigned to a shoe press 48 provided with an upper shoe press unit, here an upper shoe press roll 46.

[0053] The two doctors 16, 18 are arranged on the outer circumference of the grooved and/or blind bored opposing roll 14 at a distance from one another.

[0054] A cleaning device 50 impinging the roll surface is provided in the roll travel direction L between the two doctors 16, 18. Here, for example, a jet cleaning or spraying device can be provided for the purpose of impinging the roll surface with a pressurized medium. A fluid, in particular water, or air can be provided as the pressurized medium. A combined blowing or spray and suction device is also conceivable, for example.

[0055] In the present case, the cleaning device 50 includes at least one spray head 54 traversing crosswise to the roll travel direction L and rotating around its axis 52 (see also Figure 3) for impinging the roll surface with the respective pressurized medium. For example, this medium for impinging the roll surface can be under a

pressure that is greater than approximately 20 bar and preferably less than about 25 to 30 bar.

[0056] The spray head 54 includes at least one, in the present case at least two, nozzles 56 inclined to its axis 52. Correspondingly, the nozzle jets 58 are inclined with respect to the axis 52 (see Figure 3). If the spray head 54 is rotating in the direction of the arrow F, the nozzle jets 58 impact the grooved and/or blind bored roll surface 60 in alternating directions.

[0057] The front doctor 18 in the roll travel direction L empties the grooves 62 and/or blind bores of the roll surface 60, whereupon the use of the nozzle jets 58 becomes more effective.

[0058] According to Figure 3, the spraying head 54 can be assigned to a vapor suction device 64.

[0059] As can be seen from Figure 2, the cleaning device 50 can be enclosed and/or surrounded by a housing 66 that is open to the roll surface 60. Here, the housing 66 is sealed off from the roll surface 60 by way of the doctors 16, 18.

[0060] In the present exemplary embodiment, the rear wall 68 of the housing 66 in the roll travel direction L can be formed by a rubber blanket, for example. This rubber blanket can be provided in the region of an opening 72 leading to a groove 70 or the like. The lower boundary 74 of the enclosure 66 can be defined by the groove 70.

[0061] Fundamentally, the grooved and/or blind bored surface 60 can also be provided on a continuous belt.

[0062] In particular, the device 10 shown in Figures 2 and 3 can also be provided solely as a conditioning device in which, for example, the above-described doctors 16, 18 and cleaning device 50 are used for the purpose of evening out the amount of water supplied to the pressing nip 76 in the grooved and/or blind bored roll

surface 60 and/or to remove water from the grooved and/or blind bored roll surface 60 for the purpose of increasing the dry content of the fibrous material web, here a paper or cardboard web, to be dewatered.

**[0063]** Here, the device 50 including the spray head 54 can, for example, be provided for blowing the grooves and/or blind bores 62 (see also Figure 3) with a pressurized medium, in particular pressurized air.

**[0064]** Fundamentally, the devices for evening out and/or removing water can also include a combined blowing and suction device.

**[0065]** Finally, the devices for evening out and/or removing water can, in particular, also be provided with a device for applying a hydrodynamically produced underpressure to the roll surface 60. In the present exemplary embodiment, this underpressure producing device includes, for example, the doctor formed by a diagonally arranged doctor 18.

**[0066]** It is noted that the foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the present invention. While the present invention has been described with reference to an exemplary embodiment, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Changes may be made, within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the present invention in its aspects. Although the present invention has been described herein with reference to particular means, materials and embodiments, the present invention is not intended to be limited to the particulars disclosed herein; rather, the present invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims.

LIST OF REFERENCE CHARACTERS

- 10 Device for conditioning, cleaning, and/or keeping clean
- 12 Felt suction roll
- 14 Opposing roll
- 16 Doctor
- 18 Doctor
- 20 First press
- 22 Felt approach point
- 24 Felt
- 26 Boundary layer doctor
- 28 Lower roll
- 30 Seating stand with a spray guard running the width of the machine
- 32 Water stripping edges
- 34 Support plate
- 36 Region
- 38 Tube, rod
- 40 Tube, rod
- 42 Rubber covering
- 44 Frame
- 46 Shoe press unit
- 48 Shoe press
- 50 Cleaning device, water removal device
- 52 Axis
- 54 Spray head
- 56 Nozzle
- 58 Nozzle jet

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- 60 Roll and/or belt surface
- 62 Groove, blind bore
- 64 Vapor suctioning device
- 66 Housing, enclosure
- 68 Rear wall, rubber blanket
- 70 Groove
- 72 Opening
- 74 Lower boundary
- 76 Pressing nip
- 78 Low-pressure suction

F Arrow

L Roll and/or belt travel direction

ML Machine operating direction

a Distance